Space Weather Technical Forecast

Issued on Sunday, 27 February 2022 at 12:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Increasing electron fluence possible. Slight chance of G1/Minor Storm and R1/Minor radio blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low in the last 24 hours with a C1.5 flare observed at 27/0626 UTC, from a plage region in the southeast. There are currently two numbered sunspot regions on the visible disc. AR2954 and AR2955 are both classified as Hsx/Alpha and are located in the northern hemisphere near the centre of the disc. There are plage regions in the northeast and southeast which contain visible pores, these regions will be monitored and may develop into sunspot regions.
No Earth-directed CMEs were observed in the available imagery during the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, was initially at background levels, near 350 km/s, it increased abruptly at 27/0630 UTC to slightly-elevated levels, ending the period near 460 km/s. The density was at average levels, 4-8 ppcc but increased to above average, reaching a maximum value of around 18 ppcc. The IMF, Bt, was weak before increasing to Moderate levels around 14 nT at 27/0630 UTC. The north-south component, Bz, varied weakly at first however around 27/0630 UTC the negative Bz fell to around -14 nT, with the positive value increasing to +10 nT. These changes in the solar wind parameters are likely due to the arrival of a coronal hole co-rotating interaction region (CIR). There are three coronal holes in the western hemisphere so the exact source is uncertain though is most likely CH58. Phi angle was largely positive (away from the Sun). Resultant geomagnetic activity was Quiet (Kp 0-1) with an Active (Kp 4) interval between 27/0600-0900 UTC associated with the CH CIR arrival and an Unsettled (Kp 3) interval between 27/0900-1200 UTC as the High Speed Stream becomes established.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2 MeV) has been at background to moderate, briefly peaking high, with a peak of 1220 pfu at 26/1755 UTC. The corresponding 24-hour integrated electron fluence remained below the Active (1e8 integrated pfu) threshold on a flat trend. The 27/0001 UTC observation showing 4.01e7 integrated pfu.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be low or very low, with a chance of further C-class flares. The risk of M-class flares is slight (10%) currently with an increasing chance as potential new regions rotate onto the disc in the coming days.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently forecast. A series of coronal hole high speed stream (HSS) connections are expected during this period, with winds likely to exceed 500 km/s at times. Geomagnetic activity is expected to be Quiet to Unsettled, with a chance of Active periods, and a slight chance of G1/Minor Storm intervals.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. High energy electron flux is likely to follow an erratic rising trend, with the likelihood of exceeding the high (1e3 pfu) threshold during diurnal peaks. Electron fluence is also forecast to follow a rising trend, and may approach the Active (1e8 integrated pfu) threshold later in the forecast period, although currently expected to remain just below. Confidence is low however.

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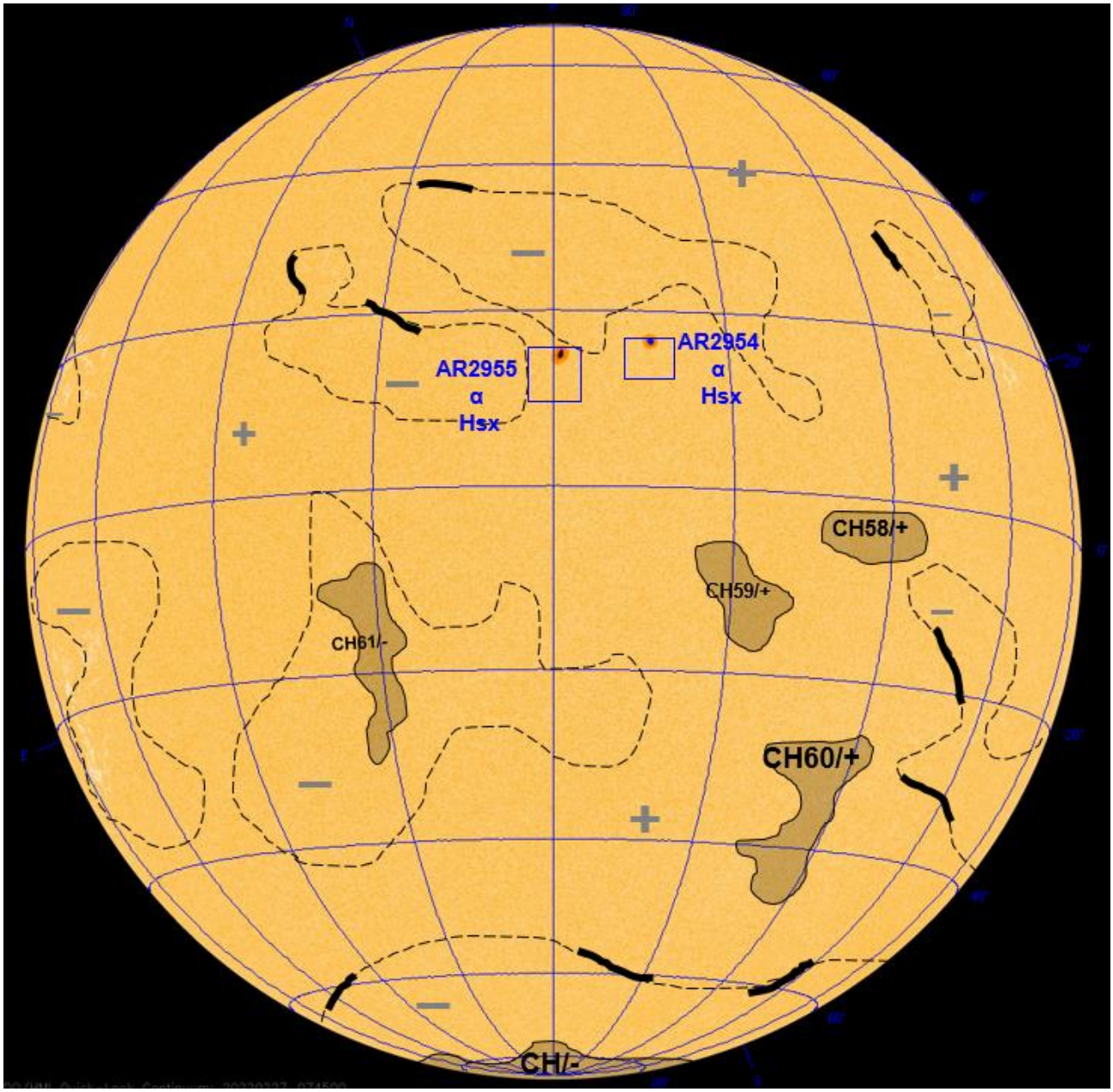
Figure 1. Solar Analysis Valid 27/0800 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are currently no Earth-directed CMEs forecast.
Solar winds are currently at slightly-elevated levels following likely connection with coronal hole 58 or 60 High Speed Stream, with a further connection with coronal hole 59 then probable on Days 2 or 3 (28 Feb - 01 Mar), probably lasting into Day 4 (02 Mar). Solar wind speeds from these holes are expected to exceed 500km/s at times, and it is probable that the effects will merge, making it difficult to tell the individual features apart when they arrive at L1. These features appeared weaker in imagery on the previous rotation, and wind speeds from the previous rotation were also contaminated by CME arrivals.
The upcoming coronal holes are all positive polarity, which are less favoured for a significant geomagnetic response at this time of year. As such, geomagnetic activity is expected to be Quiet to Unsettled, with a chance of Active periods, and a slight chance of G1/Minor Storm intervals throughout.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	10	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections - Nil

Radio Blackouts - X-Ray Flares:

Solar activity is currently at Low levels, with one C-class flare from a plage region in the southeast. There are currently two mature and stable sunspots on the visible disc. AR2954 and AR2955 are both classified as Hsx/Alpha and have shown little activity. Further active regions are beginning to rotate around the east limb onto the visible disc, with far side imagery suggesting that these could present a slight risk (10-20%) of M-class flares in the coming days. Pores are now visible in plage regions in the southeast and northeast, further analysis will be required as these may develop into Active Regions.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES 16 is at background levels, and expected to remain at this level with no solar radiation storms occurring.

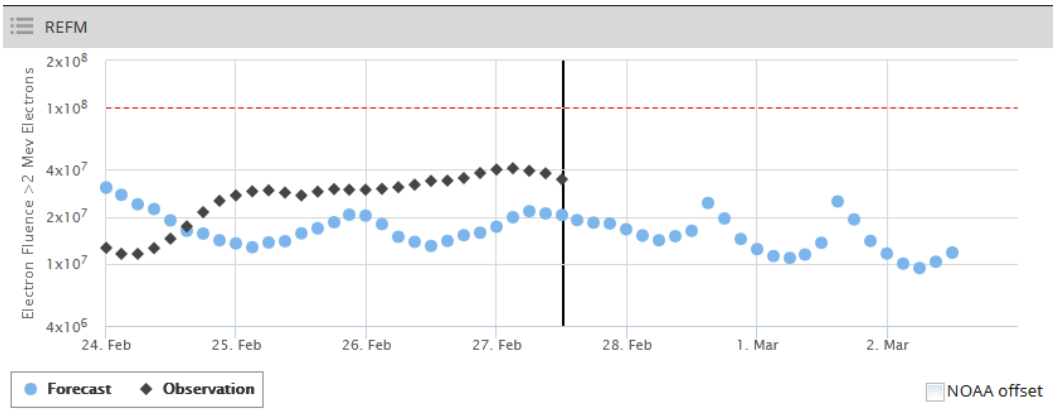
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) has dropped out to background levels. However, with Earth expected to be affected by various high speed streams in the coming days further charging is likely to occur. Any CIR associated with these arrivals may cause temporary suppression, however a general increasing trend is most probable over coming days, but with some variation in the peak values day to day. Associated electron fluence is likely to rise due to charging from the various high speed streams, but will probably stay just below the Active (1e8 integrated pfu) threshold. Confidence is low however, due to the uncertainty surrounding the charging / suppression cycle of several high speed streams in the coming days.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	20	30	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: MOSWOC REF Model is forecasting fluence levels below 1e8 Active level.



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